

Would the multipath affect AM radio? If not, why not; if so, how so? Would analog cellular telephone, which operates at much higher carrier frequencies (800 MHz vs. 1 MHz for radio), be affected or not? Analog cellular telephone uses amplitude modulation to transmit voice.

How would the usual AM receiver be modified to minimize multipath effects? Express your modified receiver as a block diagram.

Problem 6.12: Downlink Signal Sets

In digital cellular telephone systems, the base station (transmitter) needs to relay different voice signals to several telephones at the same time. Rather than send signals at different frequencies, a clever Rice engineer suggests using a different signal set for each data stream. For example, for two simultaneous data streams, she suggests BPSK signal sets that have the depicted basic signals (Figure 6.37).

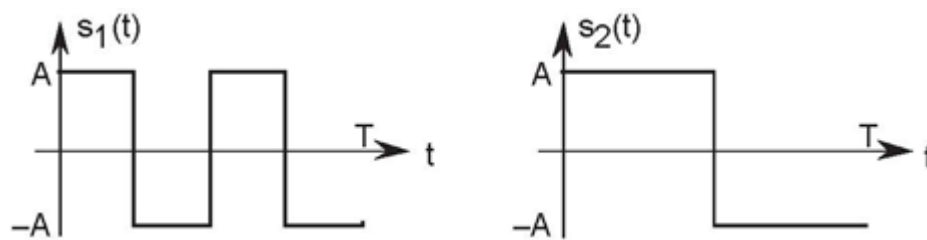


Figure 6.37

Thus, bits are represented in data stream 1 by $s_1(t)$ and $-s_1(t)$ and in data stream 2 by $s_2(t)$ and $-s_2(t)$, each of which are modulated by 900 MHz carrier. The transmitter sends the two data streams so that their bit intervals align. Each receiver uses a matched filter for its receiver. The requirement is that each receiver **not** receive the other's bit stream.

1. What is the block diagram describing the proposed system?
2. What is the transmission bandwidth required by the proposed system?
3. Will the proposal work? Does the fact that the two data streams are transmitted in the same bandwidth at the same time mean that each receiver's performance is affected? Can each bit stream be received without interference from the other?

Problem 6.13: Mixed Analog and Digital Transmission

A signal $m(t)$ is transmitted using amplitude modulation in the usual way. The signal has bandwidth W Hz, and the carrier frequency is f_c . In addition to sending this analog signal, the transmitter also wants to send ASCII text in an **auxiliary band** that lies slightly above the analog transmission band. Using an 8-bit representation of the characters and a simple baseband BPSK signal set (the constant signal +1 corresponds to a 0, the constant -1 to a 1), the data signal $d(t)$ representing the text is transmitted as the same time as the analog signal $m(t)$. The transmission signal spectrum is as shown (Figure 6.38), and has a total bandwidth B .